2021 DESIGN AND VERIFICATION™ DVCON CONFERENCE AND EXHIBITION CHINA
SHANGHAI | MAY 26, 2021

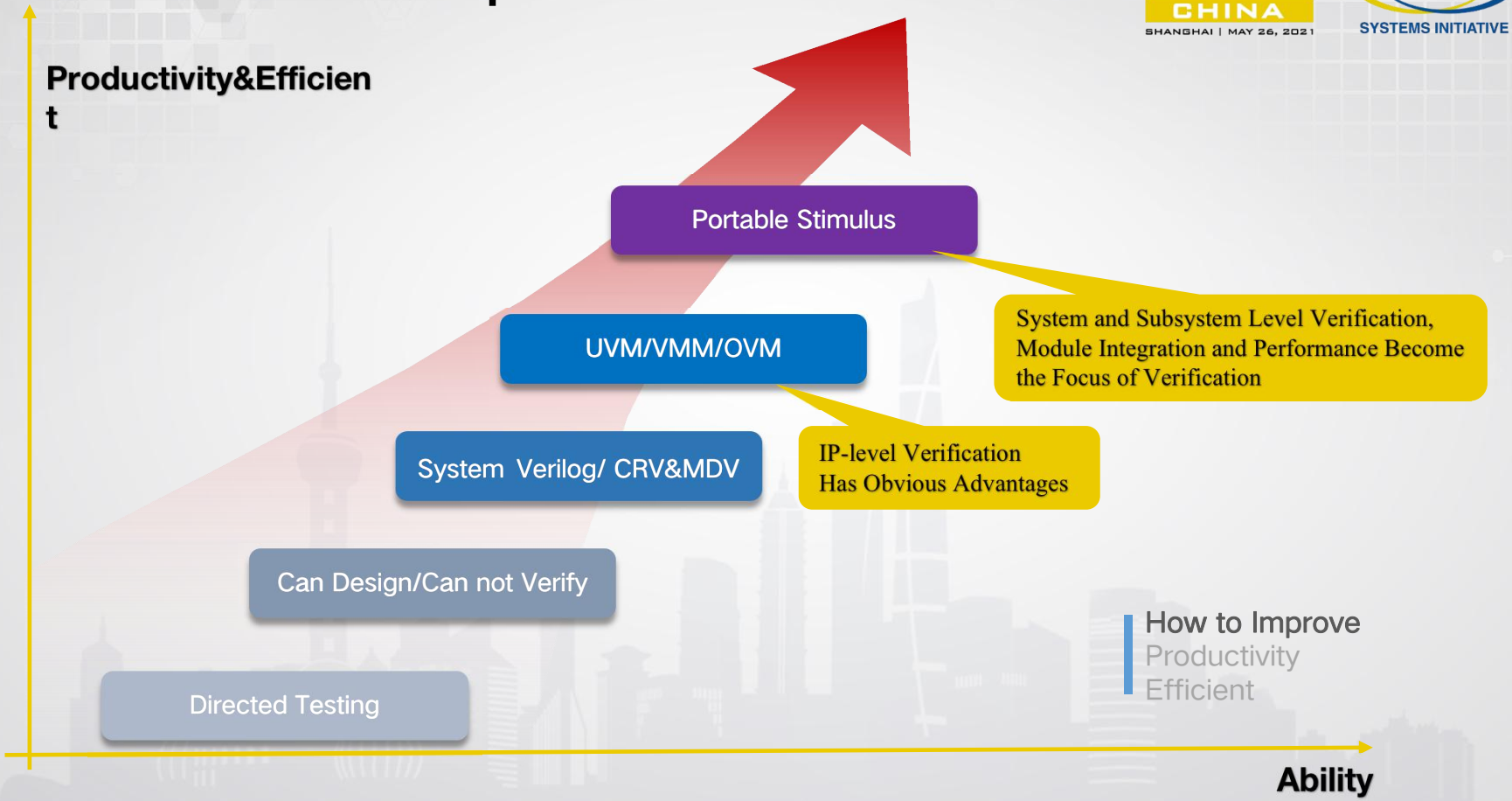
accellera SYSTEMS INITIATIVE

ZEKU

Cache Coherency Verification for CMP Based on the PSS

Yang Yang

PSS / SLN / Perspec



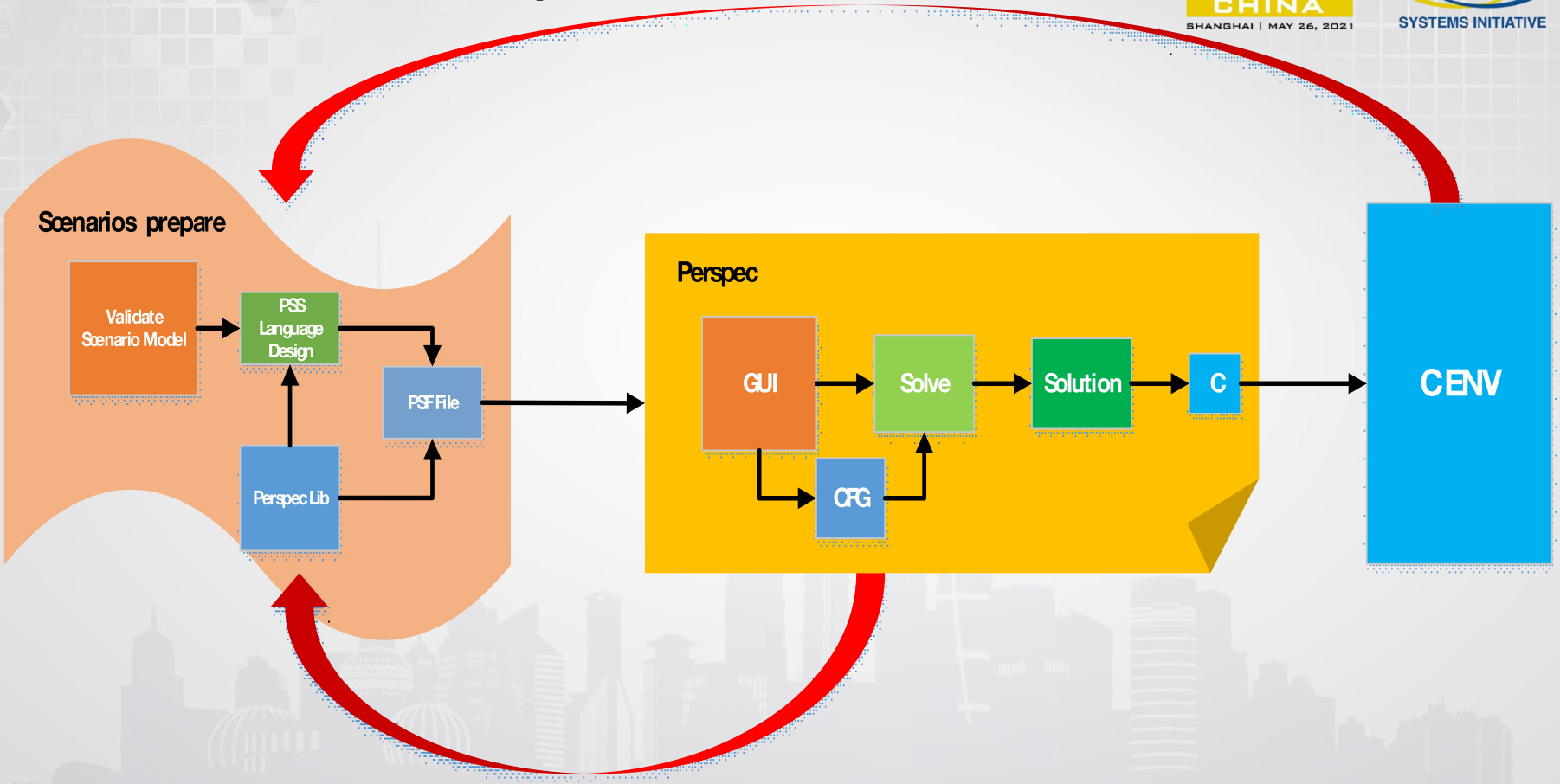
PSS / SLN / Perspec

Early Scenario Portable Scenario Language Specification
Library scenarios for the ARM architecture

PSS parsing tool
EX : Mentor InFact

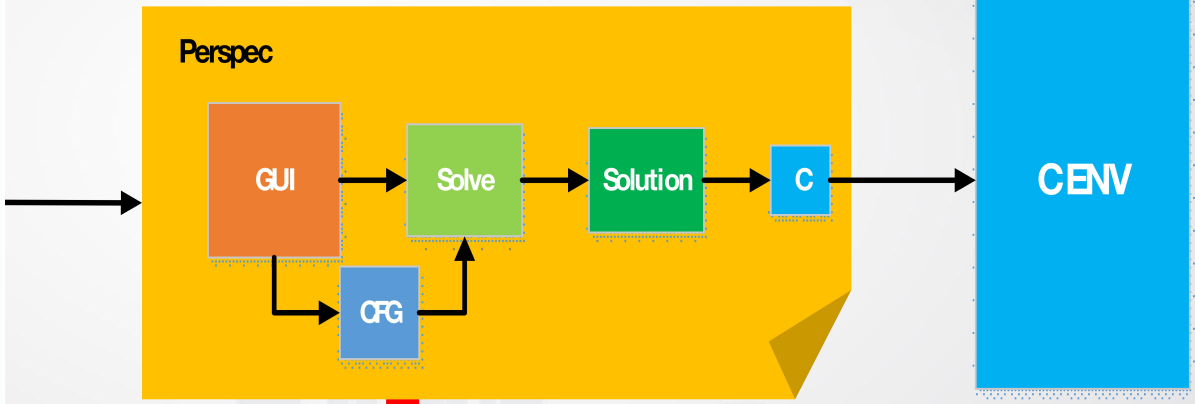
Language syntax standard based on scene description
Reuse SLN syntax rules

PSS / SLN / Perspec

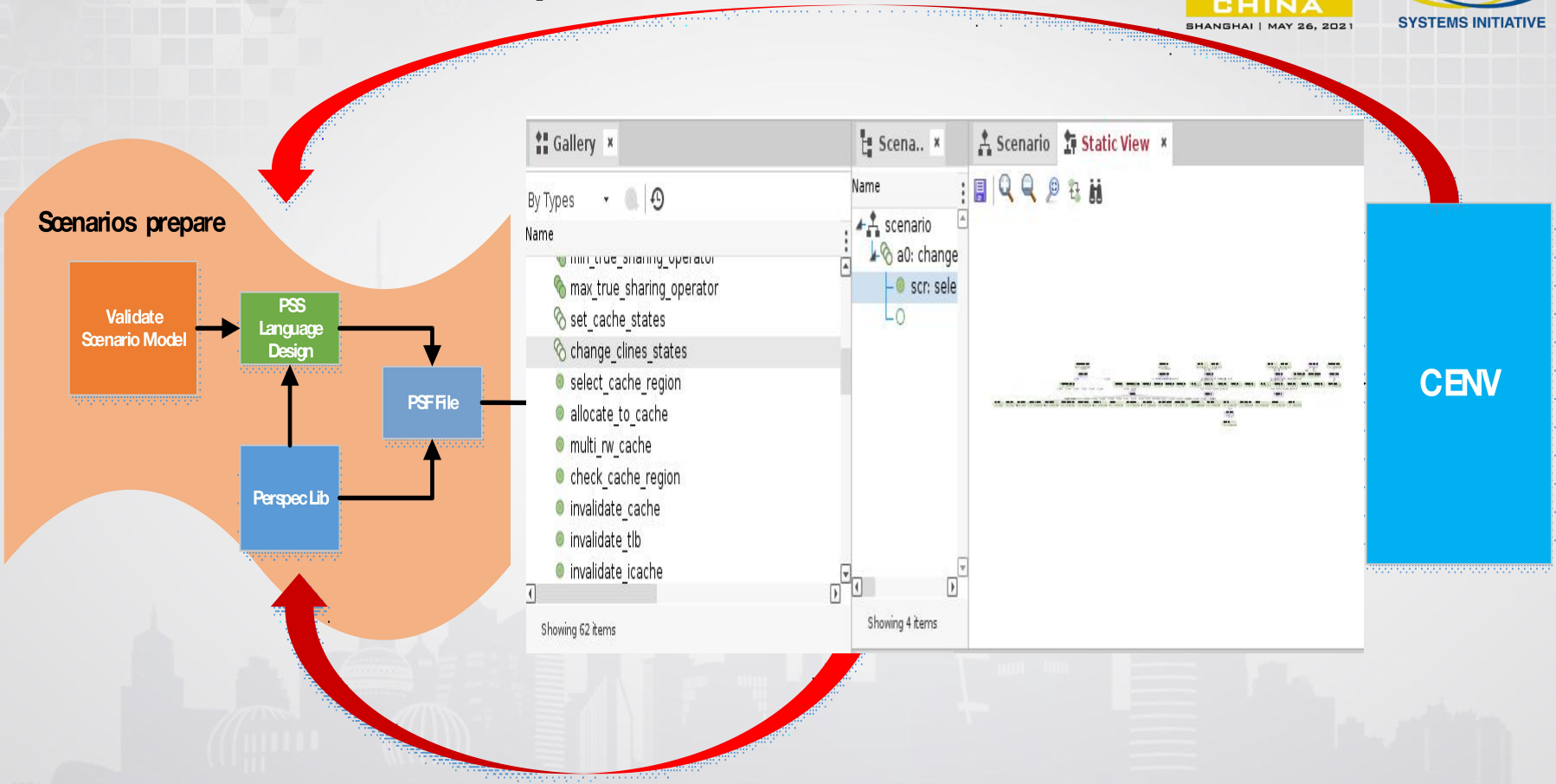


PSS / SLN / Perspec

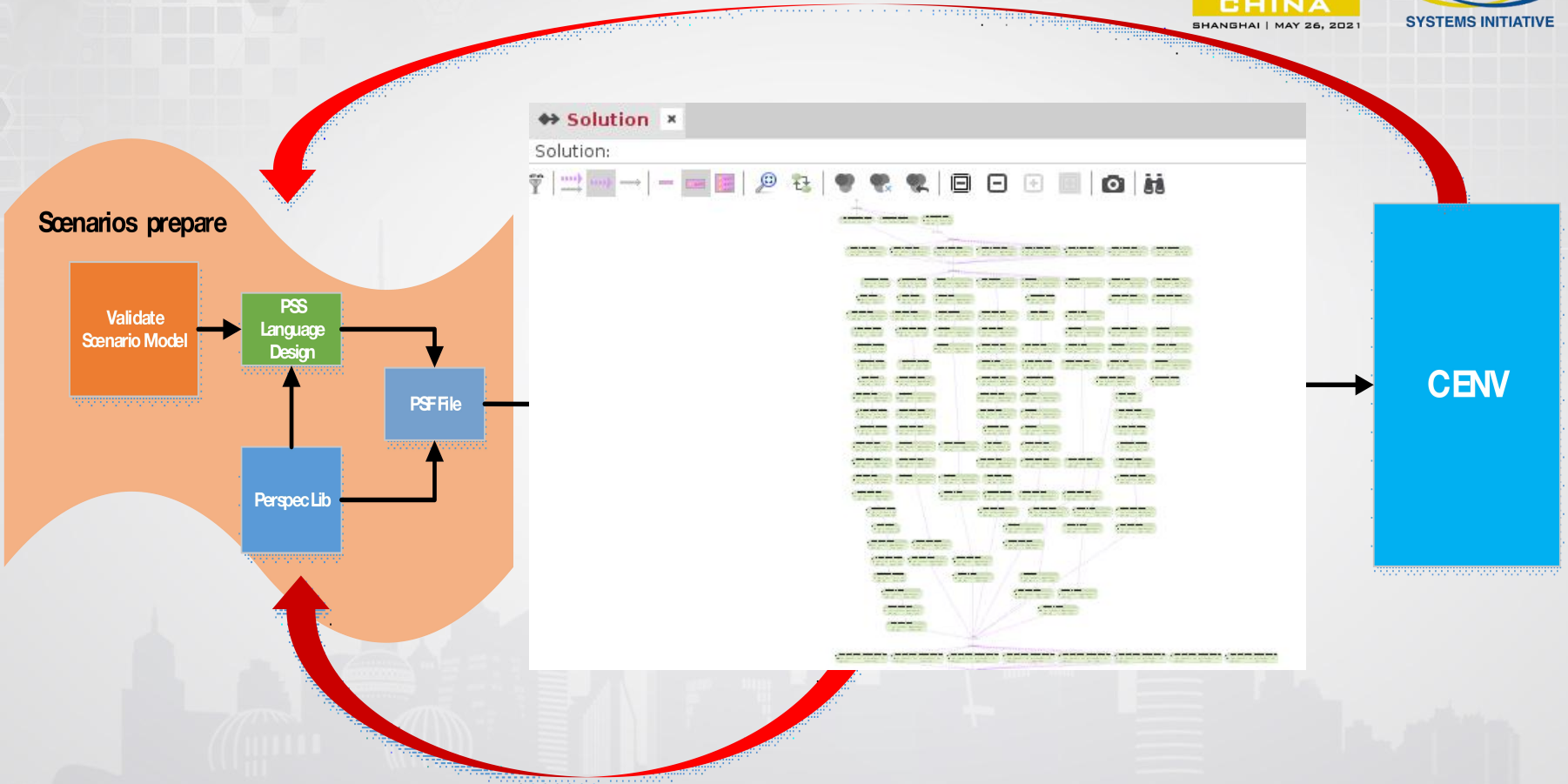
false_sharing_random_operator: false_sharing_random_operator	
cdn_coherency_ops_c	?
^num_of_clines	?
^count	?
external_alloc	FALSE
^procs_subset.selected[]	
^procs_subset.size	?
^procs_subset.cpu0_core0_selected	?
^procs_subset.cpu0_core1_selected	?
^procs_subset.cpu0_core2_selected	?
^procs_subset.cpu0_core3_selected	?
^procs_subset.cpu1_core0_selected	?
^procs_subset.cpu1_core1_selected	?
^procs_subset.cpu1_core2_selected	?
^procs_subset.cpu1_core3_selected	?
^procs_subset.num_clusters	?
^procs_subset.num_cpu0	?
^procs_subset.use_max_cores_cpu0	?
^procs_subset.num_cpu1	?
^procs_subset.use_max_cores_cpu1	?
^procs_subset.minimize_size	?
^procs_subset.num_coherent	?
^procs_subset.num_iocoherent	?
^procs_subset.num_noncoherent	?
procs_subset.apply_power_constraints	TRUE
^exclusive_access	?
^exclusive_mem_size	?
^start_with_rw	?
^use_msgs	?
^cohfull_procs_alloc_only	?
^do_allocate_to_cache	?



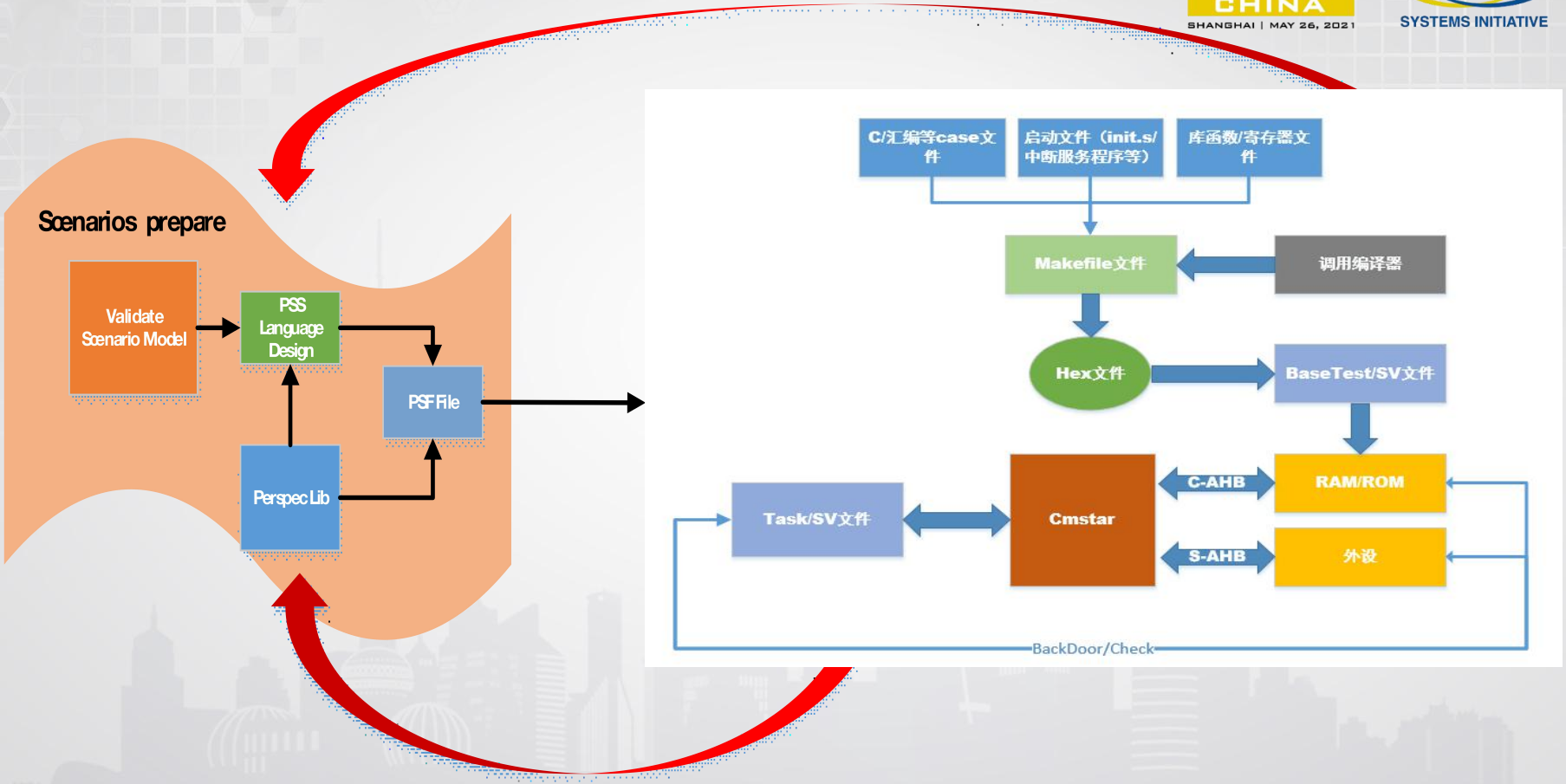
PSS / SLN / Perspec



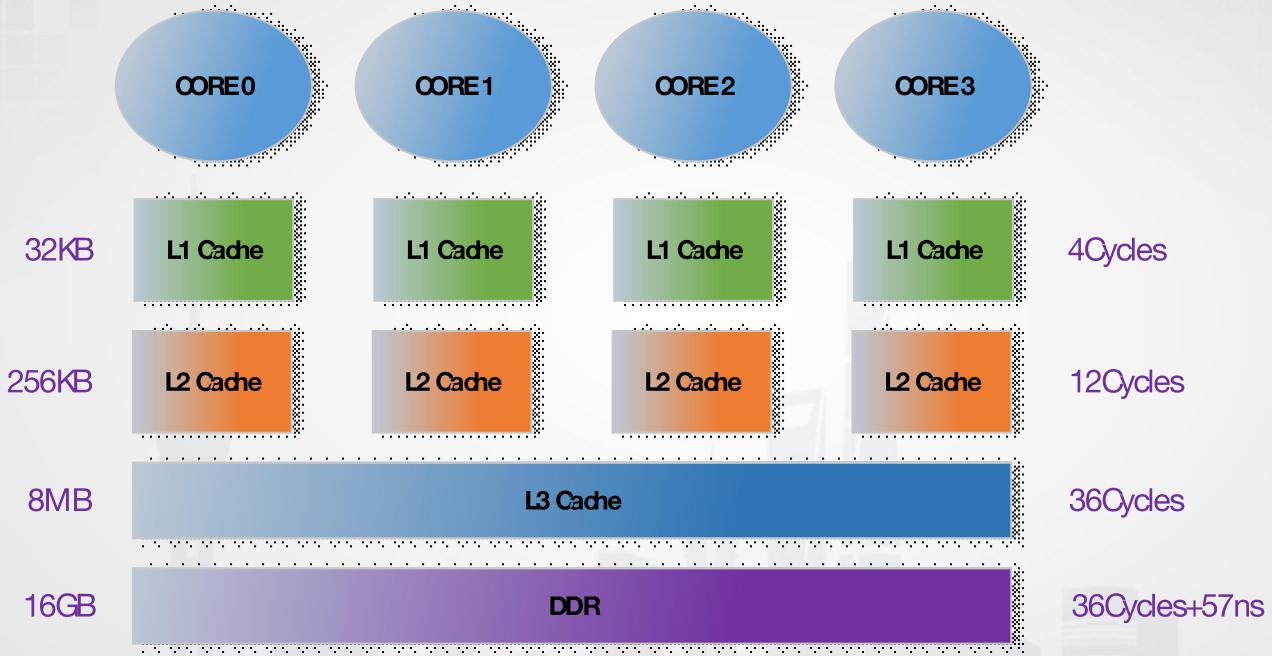
PSS / SLN / Perspec



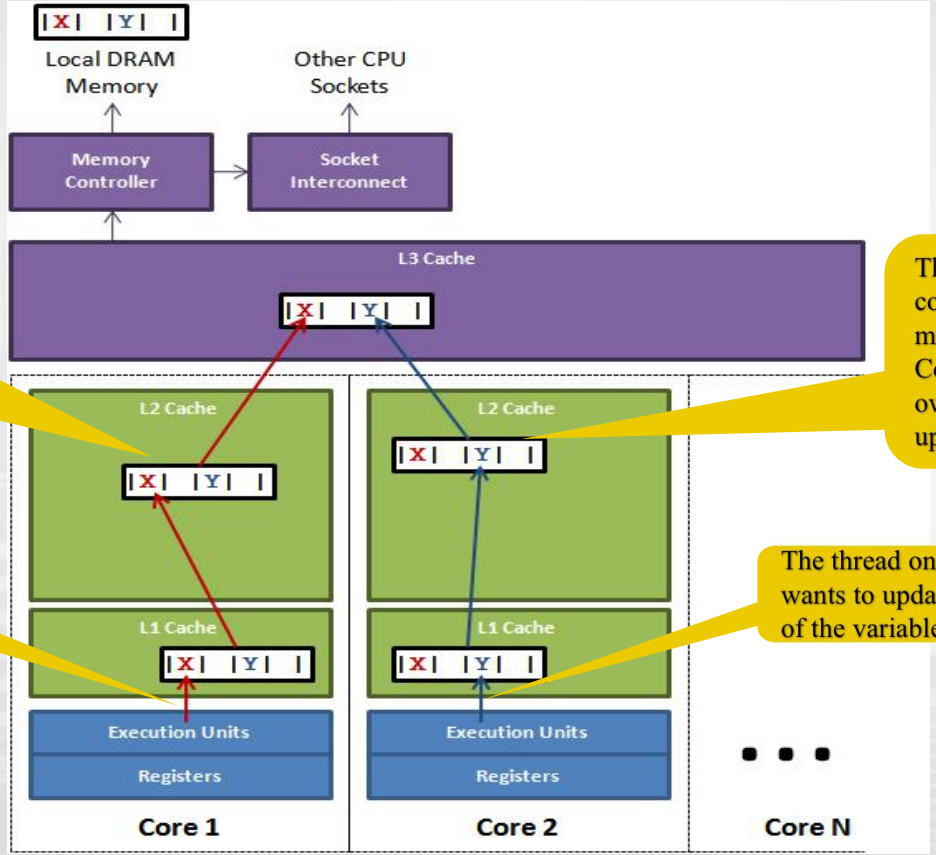
PSS / SLN / Perspec



Cache Coherency



Cache Coherency



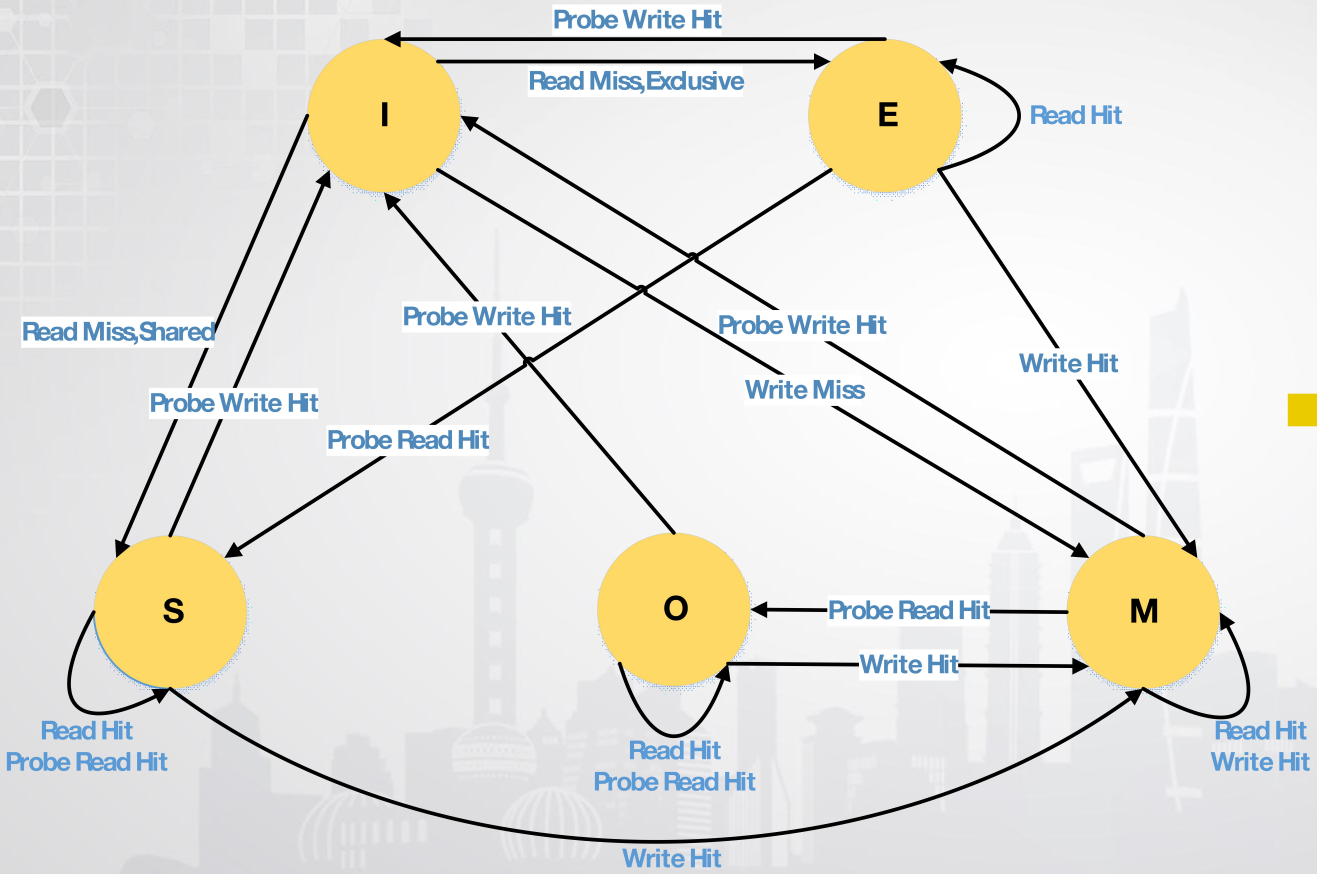
If Core1 has acquired ownership and starts updating X, the Cache Line corresponding to Core2 needs to be set to state I

The Cache Line corresponding to Core1 must be set to state I if Core2 has acquired ownership and starts updating Y

The thread on Core1 wants to update the value of variable X

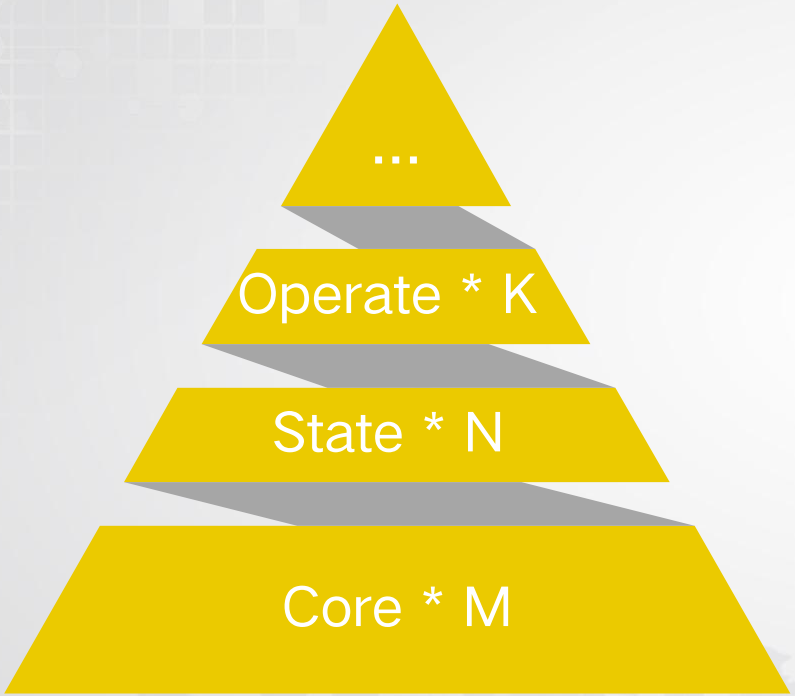
The thread on Core2 wants to update the value of the variable Y

Verification Model



State enumeration verification

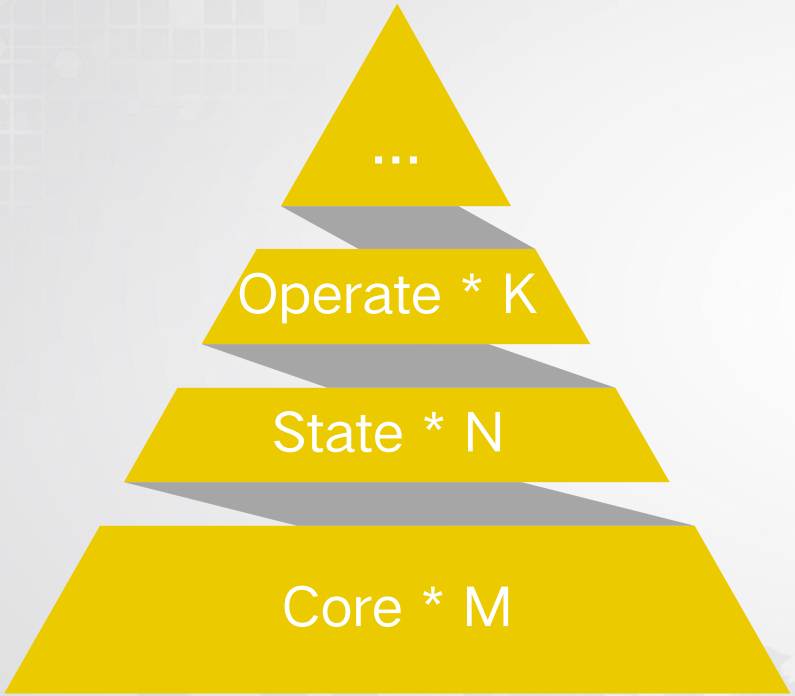
Verification Model

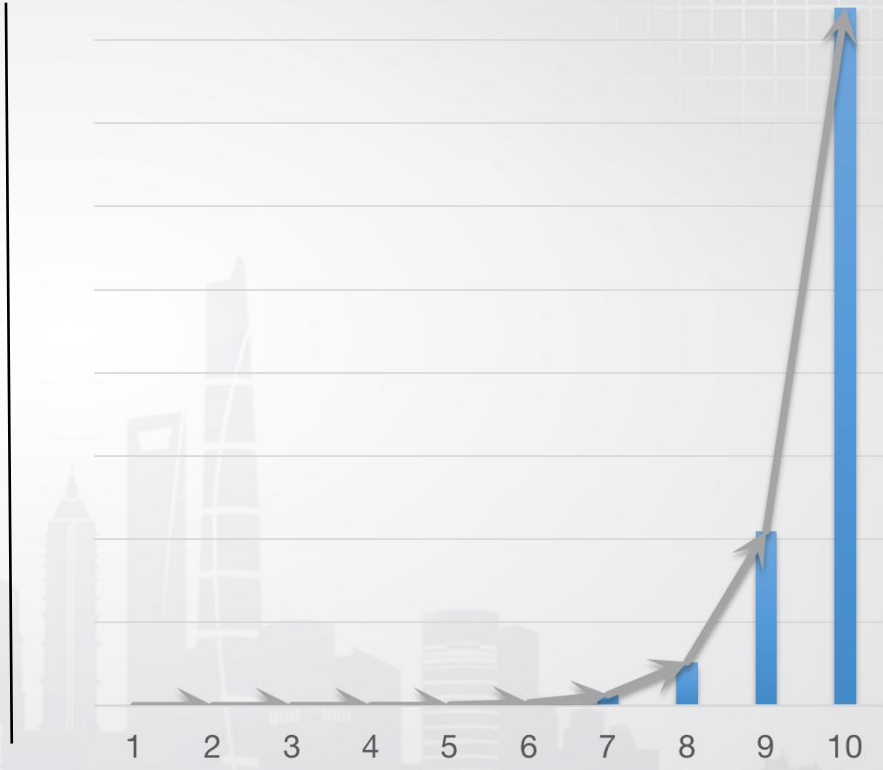


$$C = K \times N^{M}$$

$$4 \times 5^{8} = 1,562,500$$

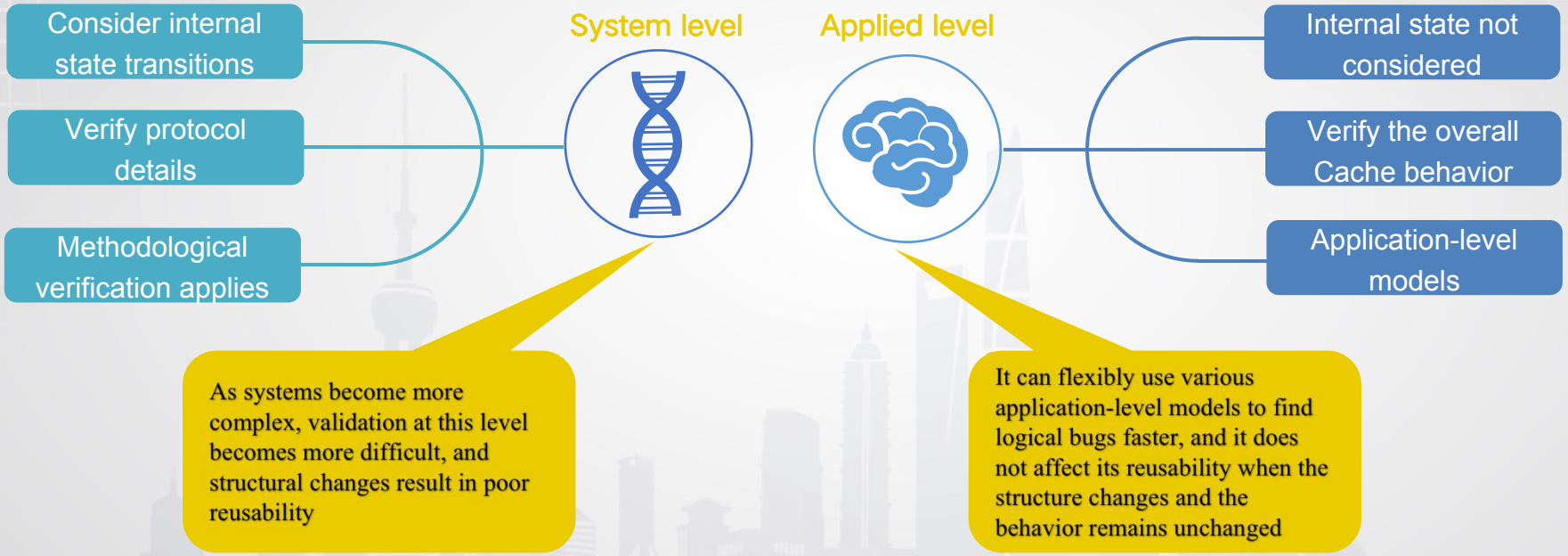
Verification Model





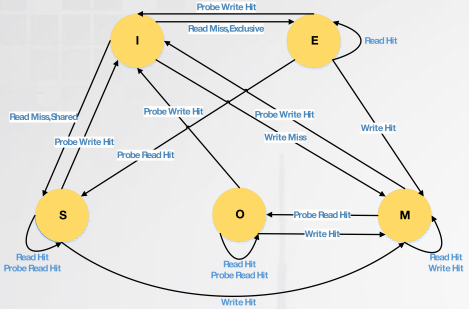
Verification Model

Verification Model

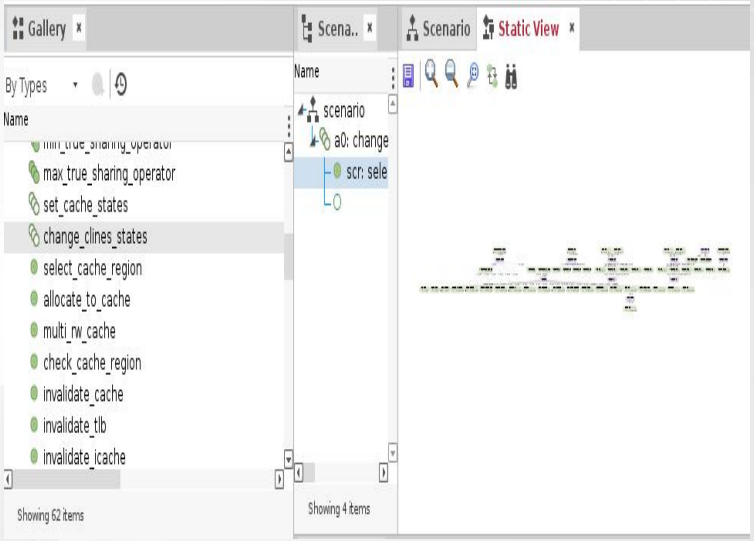


Verification Model

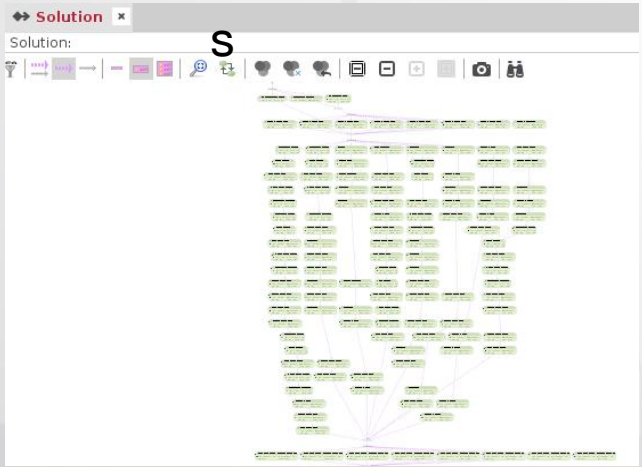
State Diagram



Model

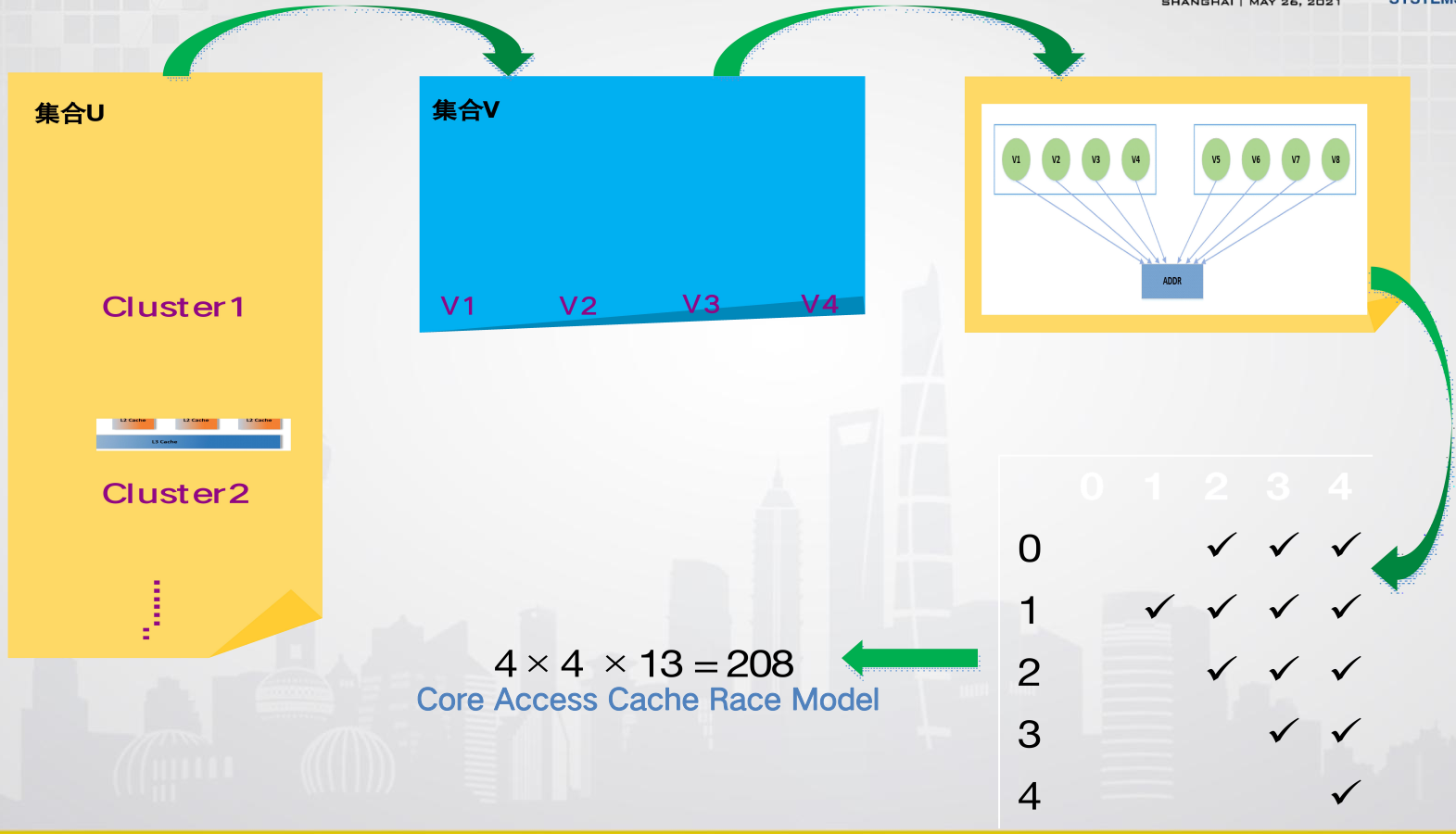


Scenarios

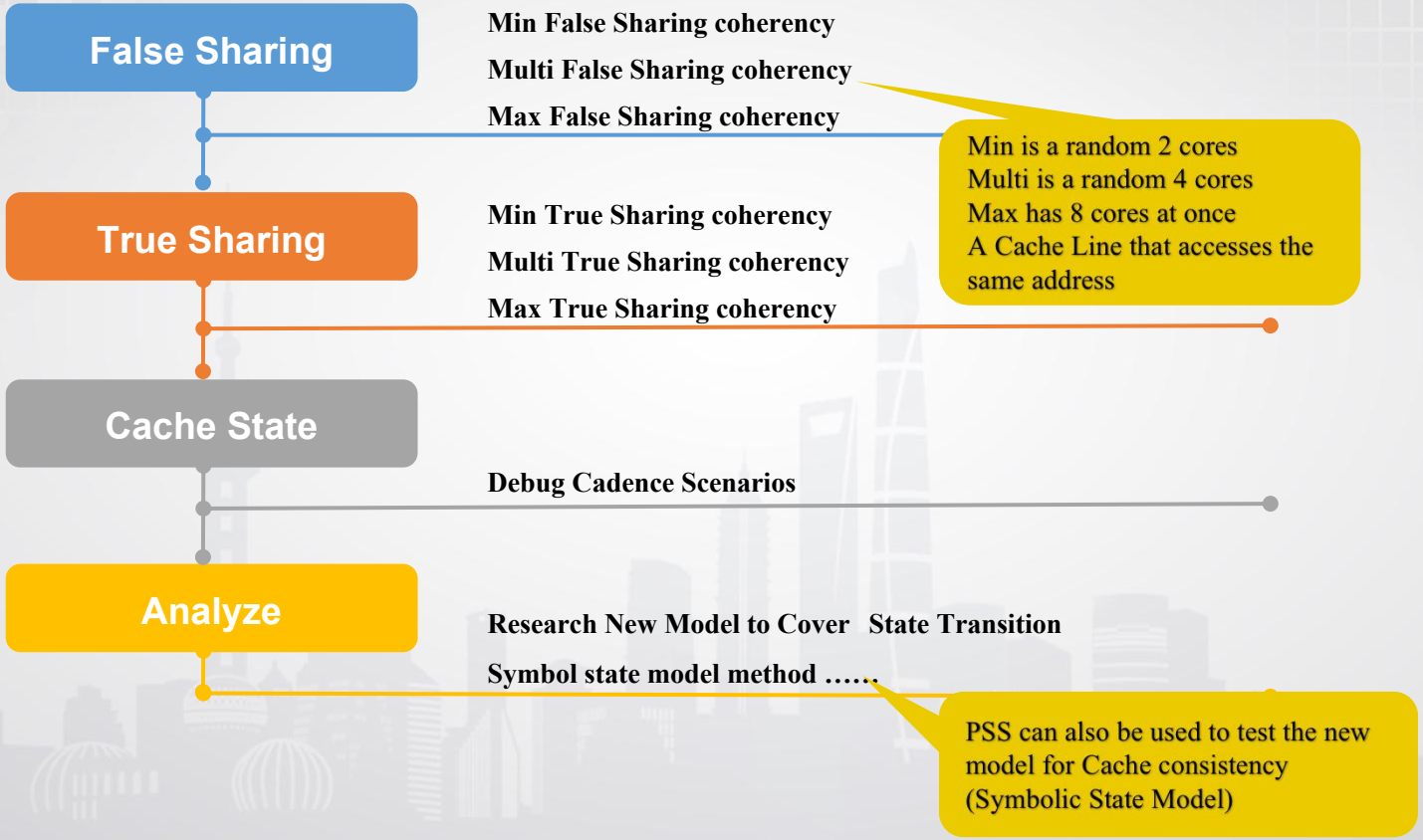


Test Case

Verification Model



Plan


False Sharing
Min False Sharing coherency
Multi False Sharing coherency
Max False Sharing coherency
Min is a random 2 cores
Multi is a random 4 cores
Max has 8 cores at once
A Cache Line that accesses the same address
True Sharing
Min True Sharing coherency
Multi True Sharing coherency
Max True Sharing coherency
Cache State
Debug Cadence Scenarios
Analyze
Research New Model to Cover State Transition
Symbol state model method ……
PSS can also be used to test the new model for Cache consistency (Symbolic State Model)

2021 DESIGN AND VERIFICATION™ DVCON CONFERENCE AND EXHIBITION CHINA
SHANGHAI | MAY 26, 2021

accellera SYSTEMS INITIATIVE

Thank You !

linshuying1994@163.com